

CASE REPORT

Life-threatening gastrointestinal bleeding from splenic artery pseudoaneurysm due to gastric ulcer penetration treated by surgical hemostasis with resuscitative endovascular balloon occlusion of the aorta: A case report

Tomonori Nakata  | Yuko Okishio | Kentaro Ueda | Toru Nasu |
Shuji Kawashima | Kosei Kunitatsu | Seiya Kato

Department of Emergency and Critical Care Medicine, Wakayama Medical University, Wakayama, Japan

Correspondence

Tomonori Nakata, Department of Emergency and Critical Care Medicine, Wakayama Medical University, 811-1 Kimiidera, Wakayama 641-8509, Japan.
Email: t-nakata@wakayama-med.ac.jp

Funding information

The authors received no funding for this study

Abstract

We report the case of a patient for whom surgical hemostasis of gastrointestinal bleeding due to a splenic artery pseudoaneurysm, which developed due to gastric ulcer penetration, was achieved with resuscitative endovascular balloon occlusion of the aorta without ischemia of organs including the spleen.

KEYWORDS

aneurysm, balloon occlusion, non-traumatic hemorrhage, shock, surgical hemostasis

1 | INTRODUCTION

Splenic artery pseudoaneurysms (SAPs) are rare causes of upper gastrointestinal bleeding (UGIB), with less than 250 reported cases in the literature.¹ Among these reported cases, SAPs are most often caused by pancreatitis (52%) or trauma (29%)² and rarely by peptic ulcer disease. To the best of our knowledge, only nine cases of SAP caused by peptic ulcers have been previously reported.²⁻¹⁰ UGIB caused by a ruptured SAP presents a significant risk of patient survival because a mortality rate of up to 90% has been reported for untreated cases,¹ and the treatment strategies used can determine whether a patient survives or dies. The use of resuscitative endovascular balloon occlusion of the aorta (REBOA) to control non-traumatic bleeding has increased¹¹⁻¹³; however, REBOA has not been used in any case report of UGIB from an SAP that

was caused by a peptic ulcer. Herein, we report the case of a patient with UGIB from an SAP caused by a peptic ulcer, who survived as a result of surgery using REBOA.

2 | CASE REPORT

A 72-year-old female patient with a history of consumption of nonsteroidal anti-inflammatory drugs for back pain visited our hospital for melena and shock by the helicopter emergency medical service. The patient had a history of atrial fibrillation and hypertension, for which she was receiving rivaroxaban (10 mg/day) and carvedilol (10 mg/day). During the emergency medical flight, the patient's blood pressure was 49/30 mmHg, and her heart rate was 50 beats per minute (bpm). She received an intravenous transfusion of crystalloid fluid and tracheal intubation

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2022 The Authors. *Clinical Case Reports* published by John Wiley & Sons Ltd.

during transit to the hospital. Upon arrival at our emergency department, the patient's vital signs and laboratory results were as follows: heart rate, 60 bpm; blood pressure, 95/44 mmHg; and hemoglobin, 4.0 g/dL. The patient received transfusion of red blood cells and fresh-frozen plasma for the treatment of anemia. Subsequent changes in her vital signs and laboratory results, as well as the transfusion volume administered, are shown in Figure 1. She underwent upper gastrointestinal endoscopy; however, a lesion was not identified in this technique because of profuse hemorrhage from the posterior wall of the stomach. Consequently, contrast-enhanced computed tomography (CT) was performed and showed the presence of free air in the abdominal cavity and a large amount of extravasated fluid in the gastric lumen (Figure 2); thus, we decided to perform surgery to achieve hemostasis. Following CT, the patient developed shock. We inserted a 7-French sheath into the right femoral artery using the Seldinger technique. Then, a REBOA catheter (RESCUE™ balloon catheter; Tokai Medical Products, Aichi, Japan) was advanced to the distal thoracic aorta. Although the patient's blood pressure had decreased immediately before surgery, we were able to control her blood pressure and intragastric hemorrhage by completely occluding the aorta with balloon inflation using the REBOA technique (Figure 3). During surgery, a circular transmural ulcer with a diameter of 30 mm was found in the posterior wall of the stomach, and after balloon deflation for 3 min, pyloric gastrectomy was performed with the balloon inflated again (Figure 4). The duration of the complete occlusion times was 20 min and 5 min, respectively (Figure 1). After the endovascular balloon was deflated, active hemorrhage from the splenic artery was detected, which resumed with figure-of-eight

suture (3–0 polypropylene). The patient was admitted to the intensive care unit (ICU) owing to the development of coagulopathy and required open abdominal management to evaluate blood flow in the gastric remnant. The maximum lactate level was 2.7 mmol/L during the operation, which was within the normal range at the time of admission to the ICU, and there was no progression of coagulopathy or increase in creatine kinase. Additionally, lactate dehydrogenase isozyme was observed after admission to the ICU. Subsequently, the patient's vital signs stabilized. A Roux-en-Y reconstruction procedure was performed on the second day of hospitalization. Follow-up contrast-enhanced CT did not show arterial embolization of the splenic artery and splenic infarction. The patient was discharged from the ICU on the third day of hospitalization and was discharged from the hospital on the 29th day of hospitalization without organ dysfunction.

3 | DISCUSSION

SAP is uncommon. In a large case series from the Mayo Clinic, 10 SAPs were found during an 18 years period.² Among previously reported cases, SAPs are most often caused by pancreatitis (52%) or trauma (29%)² and are rarely caused by peptic ulcer disease. To the best of our knowledge, there are only nine reported cases of SAPs caused by peptic ulcers.^{2–10} Thus, for a patient with UGIB after pancreatitis or trauma, a ruptured SAP should be considered in the differential diagnosis. However, the diagnosis of SAP due to a peptic ulcer poses a significant challenge for a clinician. In contrast to true aneurysms, which involve all three layers (intima, media, and adventitia) of

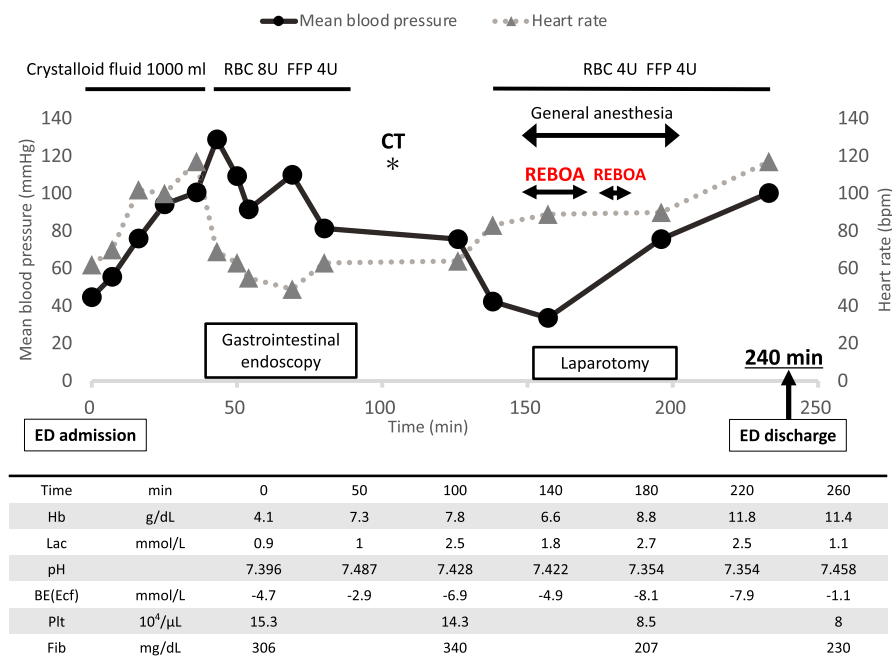


FIGURE 1 Time course of blood pressure, heart rate, and laboratory data trends in a 72-year-old woman with melena. RBC, red blood cell; FFP, fresh-frozen plasma; CT, computed tomography; REBOA, resuscitative endovascular balloon occlusion of the aorta; ED, emergency department; Lac, lactate; Hb, hemoglobin; BE, base excess; Plt, platelet; Fib, fibrinogen

FIGURE 2 Contrast-enhanced computed tomography findings of a 72-year-old woman with melena. Free air is observed in the abdominal cavity (A). The red arrows indicate a large amount of extravasated fluid in the gastric lumen (B, C)

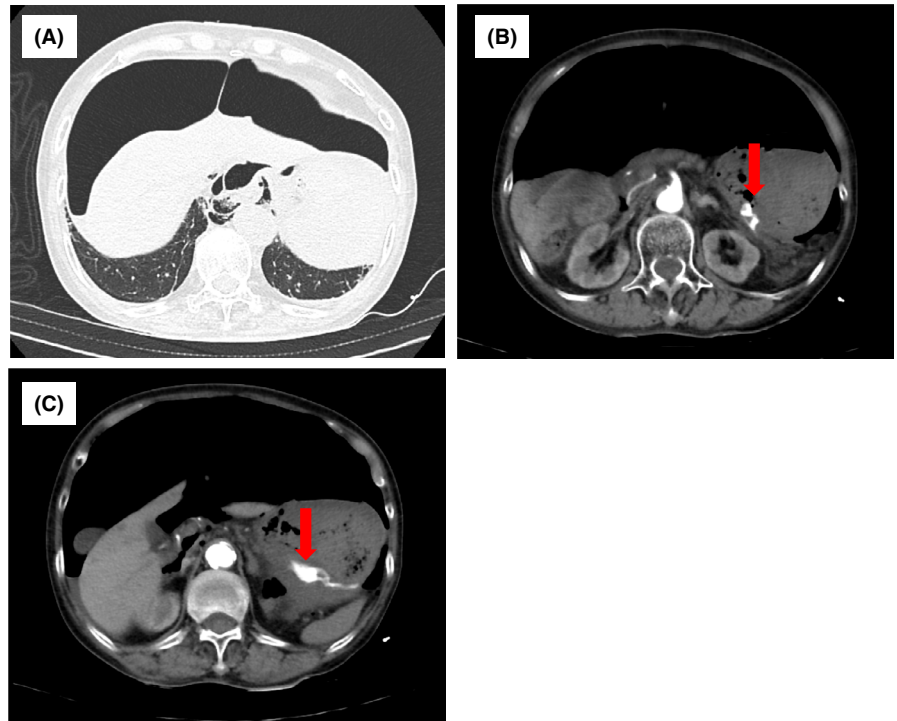


FIGURE 3 Radiography of the completely occluding aorta with balloon inflation using the REBOA technique for a 72-year-old woman with melena. Radiography shows that the balloon is distal to the left subclavian and proximal to the celiac axis

an arterial wall, pseudoaneurysms typically involve only the intima and media. Unlike true aneurysms, SAPs carry a much higher risk of rupture.³ Control of UGIB caused

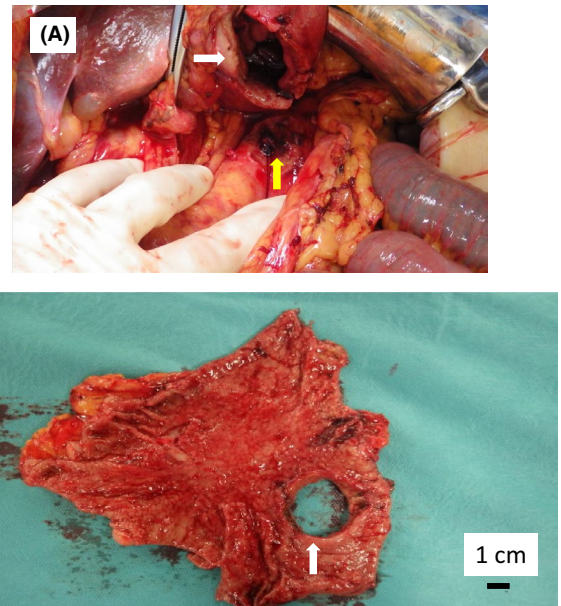


FIGURE 4 Abdominal surgery findings of a 72-year-old woman with melena. A defect with a diameter of 30 mm is seen on the posterior wall of the stomach. The white arrows indicate the perforated ulcer within the posterior wall of the stomach (A, B). The yellow arrow indicates the suture site of the splenic artery aneurysm (B)

by ruptured SAPs is critical to the survival of patients because the mortality rate for this condition can reach 90% in untreated cases,¹ and the treatment strategies selected can determine whether patients survive or die.

In cases of traumatic shock and cardiopulmonary arrest, aortic occlusion with resuscitative thoracotomy (RT) is a method of temporizing distal hemorrhage while augmenting cerebral and coronary perfusion.¹¹ Among patients in traumatic shock who did not require cardiopulmonary resuscitation before REBOA or RT, those who underwent REBOA had a significantly higher survival rate.¹¹ Recently, retrospective studies and case reports involving multiple patients have discussed the use of REBOA for the treatment of non-traumatic hemorrhagic shock including abdominal aortic aneurysm rupture, obstetrics and gynecology-derived, and UGIB.^{12–14} Because all the patients were in end-stage hemorrhagic shock, and their underlying etiologies were highly variable, in-hospital mortality was high,^{12,13} but in UGIB, the effectiveness of a balloon-assisted hemostatic technique would decrease bleeding to secure a visual field and to reduce the volume of blood transfusion.¹⁴ REBOA is increasingly utilized at high-volume trauma centers in some countries in cases of traumatic and non-traumatic shock.^{11–15} There are two types of REBOA balloon management strategies: intermittent and partial. Intermittent REBOA occludes the aorta completely, occlusion time is limited to 35–40 min in the distal thoracic aorta,¹⁵ and the occlusion process involves repeated inflation and deflation of the balloon. By contrast, partial REBOA occludes the aorta partially to minimize ischemic injury caudal to the balloon, while maintaining cerebral and coronary perfusion. Although the retrospective studies included traumatic and non-traumatic cases of hemostasis with REBOA, little consideration was given to the influence of balloon management in these cases. In our patient's case, management by intermittent REBOA was useful not only for maintaining cerebral and coronary artery perfusion but also for securing the surgical field and identifying the source of the hemorrhage. Moreover, the duration of the complete occlusion times was 20 min and 5 min, respectively. Thus, the patient recovered without organ dysfunction. Because there are no conclusive indications as to whether partial or intermittent REBOA is better for balloon management, we propose that the choice of REBOA for balloon management should be based on the hemodynamics and bleeding characteristics of lesions. Future studies must aim to clarify the adaptation of REBOA for non-traumatic hemorrhage and to consider the type of REBOA balloon management used.

4 | CONCLUSION

This case report showed that REBOA can be used to control UGIB and blood pressure during surgery for a ruptured SAP.

ACKNOWLEDGMENT

None.

CONFLICT OF INTEREST

All authors declare no conflicts of interest regarding the publication of this paper.

AUTHORS CONTRIBUTION

TN wrote the first draft of the manuscript. YO, KK, and SK reviewed and revised the manuscript. YO, KU, TN, and SK performed the surgery and contributed to patient care. All authors read and approved the final manuscript.

ETHICAL APPROVAL

The study was conducted ethically in accordance with the World Medical Association Declaration of Helsinki.

CONSENT

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

DATA AVAILABILITY STATEMENT

Data supporting the conclusions are included in the article.

ORCID

Tomonori Nakata  <https://orcid.org/0000-0001-8013-2297>

REFERENCES

1. Cartelle AL, Uy PP, Yap JEL. Acute gastric hemorrhage due to gastric cancer eroding into a splenic artery pseudoaneurysm: two dangerously rare etiologies of upper gastrointestinal bleeding. *Cureus*. 2020;12:e10685.
2. Tessier DJ, Stone WM, Fowl RJ, et al. Clinical features and management of splenic artery pseudoaneurysm: case series and cumulative review of literature. *J Vasc Surg*. 2003;38:969-974.
3. Varshney P, Songra B, Mathur S, et al. Splenic artery pseudoaneurysm presenting as massive hematemesis: a diagnostic dilemma. *Case Reports in Surgery*. 2014;2014:501937.
4. Sawicki M, Marlicz W, Czaplak N, et al. Massive upper gastrointestinal bleeding from a splenic artery pseudoaneurysm caused by a penetrating gastric ulcer: case report and review of literature. *Polish Journal of Radiology*. 2015;80:384-387.
5. Pasumarthy L, Kumar RR, Srour J, Ahlbrandt D. Penetration of gastric ulcer into the splenic artery: a rare complication. *Gastroenterology Research*. 2009;2:350-352.
6. Panzera F, Inchingolo R, Rizzi M, et al. Giant splenic artery aneurysm presenting with massive upper gastrointestinal bleeding: a case report and review of literature. *World J Gastroenterol*. 2020;26:3110-3117.
7. Menaria P, Muddana V. Unusual case of life-threatening gastrointestinal bleed from a splenic artery pseudoaneurysm:

- case report and review of literature. *Case Rep Gastrointest Med.* 2019;2019:8528906.
8. Syed SM, Moradian S, Ahmed M, Ahmed U, Shaheen S, Stalin V. A benign gastric ulcer eroding into a splenic artery pseudoaneurysm presenting as a massive upper gastrointestinal bleed. *J Surg Case Rep.* 2014;2014(11):rju102.
 9. Cho SB, Park SE, Lee CM, et al. Splenic artery pseudoaneurysm with splenic infarction induced by a benign gastric ulcer: a case report. *Medicine (Baltimore).* 2018;97:e11589.
 10. Haivas CD, Kessler S. Splenic artery pseudoaneurysm causing brisk upper-GI bleed from gastric ulcer. *Gastrointest Endosc.* 2016;84:540-541.
 11. Brenner M, Inaba K, Aiolfi A, et al. Resuscitative endovascular balloon occlusion of the aorta and resuscitative thoracotomy in select patients with hemorrhagic shock: early results from the American association for the surgery of trauma's aortic occlusion in resuscitation for trauma and acute care surgery registry. *J Am Coll Surg.* 2018;226:730-740.
 12. Hoehn MR, Hansraj NZ, Pasley AM, et al. Resuscitative endovascular balloon occlusion of the aorta for non-traumatic intra-abdominal hemorrhage. *Eur J Trauma Emerg Surg.* 2019;45:713-718.
 13. Matsumura Y, Matsumoto J, Idoguchi K, et al. Non-traumatic hemorrhage is controlled with REBOA in acute phase then mortality increases gradually by non-hemorrhagic causes: DIRECT-IABO registry in Japan. *Eur J Trauma Emerg Surg.* 2018;44:503-509.
 14. Sano H, Tsurukiri J, Hoshiai A, Oomura T, Tanaka Y, Ohta S. Resuscitative endovascular balloon occlusion of the aorta for uncontrollable nonvariceal upper gastrointestinal bleeding. *World Journal of Emergency Surgery.* 2016;11:20.
 15. Hoareau GL, Tibbits EM, Beyer CA, et al. Resuscitative endovascular balloon occlusion of the aorta: review of the literature and applications to veterinary emergency and critical care. *Frontiers in Veterinary Science.* 2019;6:197.

How to cite this article: Nakata T, Okishio Y, Ueda K, et al. Life-threatening gastrointestinal bleeding from splenic artery pseudoaneurysm due to gastric ulcer penetration treated by surgical hemostasis with resuscitative endovascular balloon occlusion of the aorta: A case report. *Clin Case Rep.* 2022;10:e05561. doi:[10.1002/ccr3.5561](https://doi.org/10.1002/ccr3.5561)